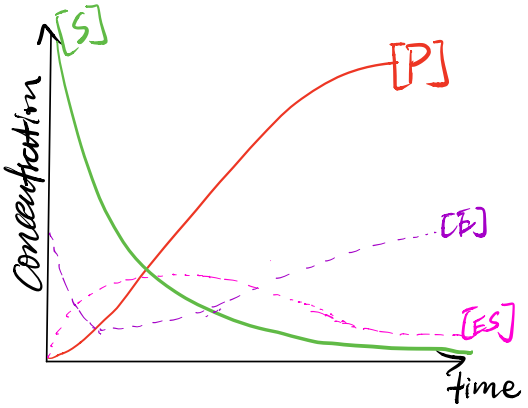
$$E + S \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_3} E + P$$

→ At the beginning:

[P] is Low
[S] is high
[E] is high
[ES] is Low



→ As reaction processing:

[P] ↑
[S] ↓
[E] ↓
[ES] ↑

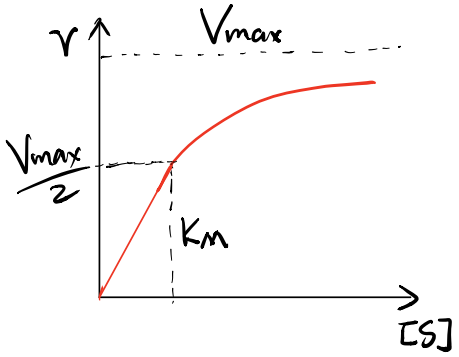
→ Reference by Michaelis-Menten equation:

1) $K_m = \frac{k_2 + k_3}{k_1}$

2) $V_{max} = k_3 [E]_T$

3) $[E]_T = [E] + [ES]$

4) $V = \frac{V_{max}[S]}{K_m + [S]}$



8.1 4 equations for the rate of changes of the four species, E, S, ES, and P.

$$\frac{d[E]}{dt} = -k_1[E][S] + (k_2+k_3)[ES]$$

$$\frac{d[S]}{dt} = -k_1[E][S] + k_2[ES]$$

$$\frac{d[ES]}{dt} = k_1[E][S] - (k_2+k_3)[ES]$$

$$\frac{d[P]}{dt} = k_3[ES]$$

* Once $\frac{d[ES]}{dt} = 0 = k_1[E][S] - (k_2+k_3)[ES]$

We can use it to prove,

$$[ES] = \frac{k_1[E]_T[S]}{(k_2+k_3)+k_1[S]} = \frac{[E]_T[S]}{K_M+[S]}$$

$$v = k_3[ES] = \frac{k_3[E]_T[S]}{K_M+[S]} \; ; \; [E]_T = [ES] \; ; \; V_{max} = k_3[E]_T$$

$$V = V_{max}[S] / K_M+[S]$$

8.3